

The Association of School Environments With Youth Physical Activity

ABSTRACT

Objectives. This study assessed the association of school environmental characteristics with student physical activity on campus.

Methods. Physical activity areas ($n=137$) at 24 public middle schools were assessed for area type, size, and improvements (e.g., basketball courts). Student physical activity and the presence of equipment and supervision were directly observed before school, after lunch, and after school.

Results. Environmental characteristics explained 42% of the variance in the proportion of girls who were physically active and 59% of the variance for boys.

Conclusions. School environments with high levels of supervision and improvements stimulated girls and boys to be more physically active. (*Am J Public Health*. 2001;91:618–620)

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Ecologic models of behavior lead to hypotheses that environmental characteristics can influence physical activity.¹ Schools are particularly important environments for children. Identifying environmental correlates of student physical activity could facilitate interventions that benefit all children at school. The present study tested the hypothesis that schools with adequate space, facilities, equipment, and supervision stimulate students to be physically active at school during free time.

Methods

Twenty-four public middle schools (grades 6–8) in San Diego County, Calif, were studied during spring 1997. Mean enrollment was 1081 students ($SD=352$); 43% were non-White, 39% received subsidized meals, and 38% were bused.

All potential physical activity areas at schools were assessed by observation. Environmental variables included the following: (1) *area type*—*court* space with permanent marks or improvements, *open field* space with no markings, and *indoor* activity space including multipurpose rooms and gymnasiums; (2) *area size* in square meters; (3) *permanent improvements*, including number of basketball hoops, tennis courts, baseball diamonds, and football or soccer goals. Two assessors agreed on the coding. Schools had from 2 to 8 activity areas (mean=6.3; total=151).

SOPLAY (System for Observing Play and Leisure Activity in Youth) was used by trained assessors to code the number of participants and their activity levels.² Activity areas were “scanned” for girls and boys, and they were observed separately on fixed schedules during 3 time periods: before school, during lunch, and after school. The physical activity of each student was coded as sedentary, walking, or very active (more active than walking) by validated codes.^{3,4} Assessors recorded temperature, accessibility of the area, and the

presence of supervision, organized activities, and equipment. Each school was observed on 3 randomly scheduled days (total=72 days) with fair weather. Interobserver reliabilities were 90%.

Each accessible area was a “case.” The dependent variable was the number of children in an area who were engaged in moderate to vigorous physical activity, averaged across 3 time periods and 3 assessment days and divided by the average attendance. Initial sex-specific linear regressions included 6 school demographic variables: percentage of non-White students, percentage receiving subsidized lunch, percentage bused, school start time, school end time, and mean parental education (derived from a parent survey [$n=1609$; response rate=72%]). Environmental variables were as follows: temperature during observation; area type; area size; total improvements; and proportion of observations with equipment, supervision, and organized activities. Three a priori interactions were included. Variables with $P>.20$ were deleted from final models.

Results

Of the 151 areas, 137 were accessible to students. Forty-four percent of areas were

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TABLE 1—Multiple Regression Results Explaining Variance in Students' Participation in Moderate to Vigorous Physical Activity, With School Environment Variables

	Girls ^a			Boys ^b		
	F score	P	Eta ²	F score	P	Eta ²
Intercept	1.85	.176	.015	0.13	.724	.001
% students bused	2.54	.113	.020	NS		
Area type	3.97	.021	.061	0.29	.751	.005
Area size	5.80	.018	.045	2.54	.114	.020
Improvements	6.29	.013	.049	1.70	.195	.014
Supervision	0.02	.896	.000	0.26	.612	.002
Equipment	0.02	.883	.000	14.18	.001	.103
Organized activities	NS			2.40	.124	.019
Area type×supervision	3.71	.027	.057	3.11	.048	.048
Area type×equipment	4.68	.011	.071	11.91	.001	.162
Improvements×supervision	15.15	.001	.110	12.01	.001	.089
Full model	9.13	.001	.471	17.45	.001	.630

Note. NS=variable not entered in model. Eta² indicates the proportion of variance explained by the variable.

^aR² = .471 (adjusted R² = .419)

^bR² = .630 (adjusted R² = .594)

outdoor courts, 43% were outdoor fields, and 13% were indoors. The mean number of permanent improvements was 66.6 per school (SD=20.5; range=10–97). The most common improvements were basketball hoops and courts (100% of schools), baseball backstops (87%), volleyball nets (87%), ten-

nis courts (79%), and racquetball courts (62%).

To obtain a schoolwide estimate of the proportion of physically active students, we summed average rates of moderate to vigorous physical activity across activity areas. The proportion of girls observed being physically

active ranged from 0% to 5% across schools, with a mean of 1.6% (SD=1.2%). The proportion of physically active boys ranged from 1% to 11%, with a mean of 5.5% (SD=2.7%).

The final multiple regression model for girls explained 42% of the variance in observed physical activity (Table 1). The interaction “area type×supervision” explained 11% of the variance and revealed that supervision was most important in indoor areas (Figure 1). The interaction “area type×equipment” indicated that more girls were active when equipment was *not* present in indoor areas, but equipment enhanced activity levels in outdoor areas (Figure 2). The interaction “supervision×area improvements” indicated that girls were most active when school environments had high levels of both improvements and supervision (Figure 3).

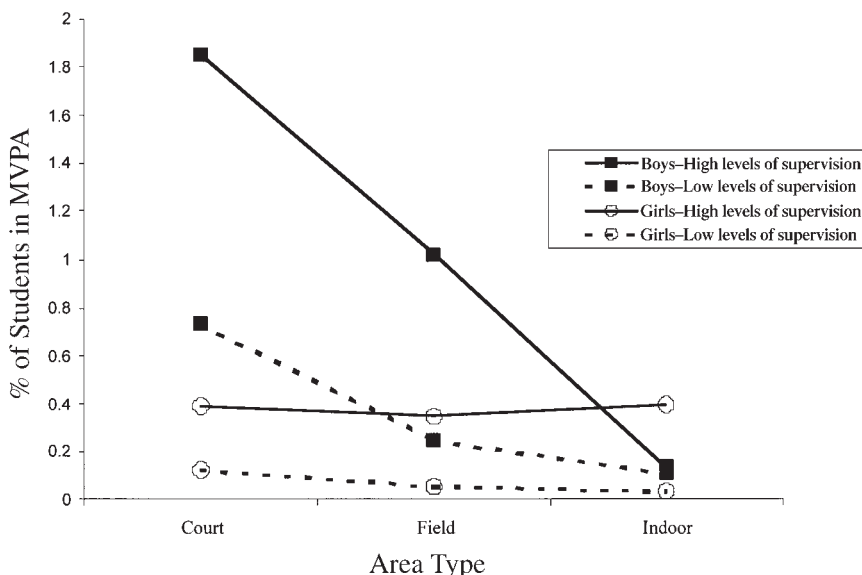
The final model for boys explained 59% of the variance in physical activity (Table 1). Figure 1 shows that boys were most likely to be active on courts with high supervision. Figure 2 indicates that the largest proportion of boys were active on courts when equipment was available. The interaction “area type×equipment” explained 16% of the variance. Figure 3 shows that the highest proportion of boys were active when areas had high levels of both improvements and supervision.

Discussion

The main findings of this study can be summarized by paraphrasing a line from the movie *Field of Dreams*: If we build it, they will come—and be active.

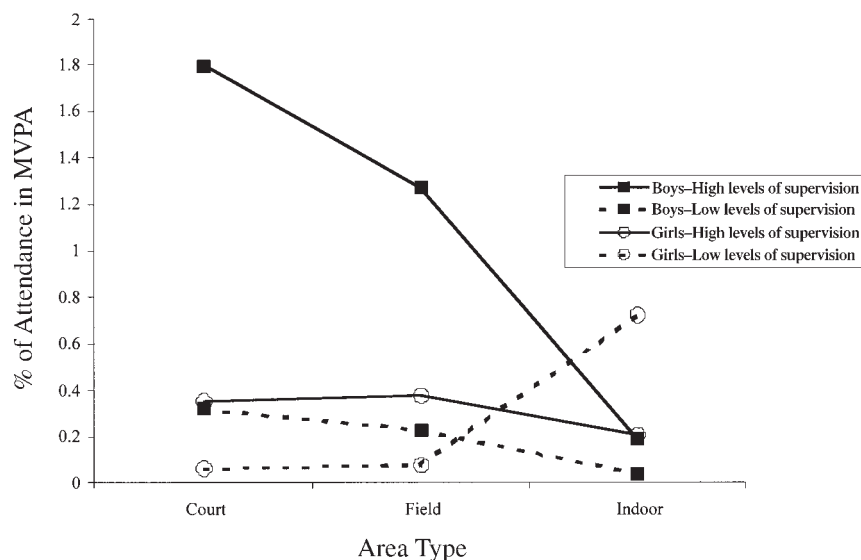
A small number of environmental variables and 3 a priori interactions explained 42% of the variance in girls' non-physical education physical activity and 59% of the variance for boys. The results raise the possibility that making realistic improvements to school environments could increase the physical activity of students throughout the school day. When the school environment had high levels of both physical improvements and adult supervision, the percentage of physically active boys and girls was 4-fold and 5-fold higher, respectively, than when the school environment was deficient in both.

A striking finding was the very small percentage of students who chose to be physically active during unstructured time: fewer than 2% of girls and 6% of boys. An absence of environmental support was associated with near-zero levels of student physical activity. However, the study did not determine what proportion of students would be stimulated to be physically active in an “optimal” school physical activity environment. It is not clear how much further improvements in school environments could boost student physical activity.



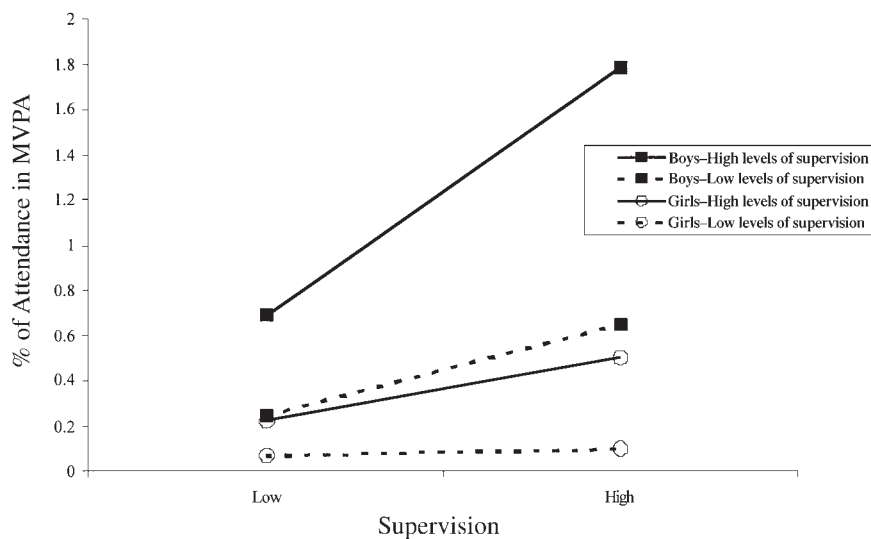
Note. “% of students in MVPA” is the percentage of boys and girls attending school who were observed to engage in moderate to vigorous physical activity (MVPA) during free time throughout the school day. High and low levels of variables were determined by median splits. Data are based on observations in 137 activity areas.

FIGURE 1—Area type×supervision: interactions for boys and girls.



Note. See note for Figure 1.

FIGURE 2—Area type × equipment: interactions for boys and girls.



Note. See note for Figure 1.

FIGURE 3—Supervision × improvements: interactions for boys and girls.

Strengths of the study included objective measurement of all variables, the dependent variable that reflected population-

wide physical activity, and multiple observation days at schools. Because the study was conducted in one region with favorable

weather, generalization to other regions needs to be tested.

Girls and boys were more likely to choose to be physically active when there were many improvements to activity areas and when adults supervised activities. Interventions that enhance school physical environments and social resources are expected to be effective in attracting students to activity areas and stimulating student physical activity. □

Contributors

J.F. Sallis was the lead author and made most of the revisions. T.L. Conway, J.J. Prochaska, and S.J. Marshall contributed to conceptualizing and running the statistical analyses. Each author wrote a portion of the original draft and edited all versions: J.F. Sallis drafted the introduction and part of the Discussion section; T.L. Conway drafted part of the Discussion section and contributed to the Methods section; J.J. Prochaska wrote the analysis methods and the Results section; T.L. McKenzie drafted the measurement methods; S.J. Marshall contributed to the Methods section; and M. Brown drafted the part of the Methods section dealing with subjects and setting.

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The study was approved by the Committee for the Protection of Human Services, San Diego State University.

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